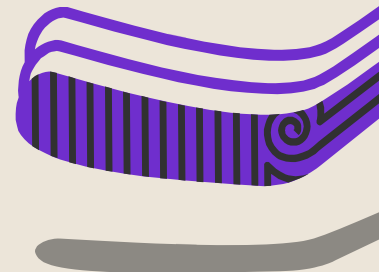


# ***DRAW 2***

IDENTIFYING THE KEY PLAYERS IN  
DRAWING NHL POWER PLAYS

Katherine Gong & Bethany Gonzalez

Project Advisors: Katerina Wu, Caleb Peña, & Jacob Pavlovich  
from the Pittsburgh Penguins

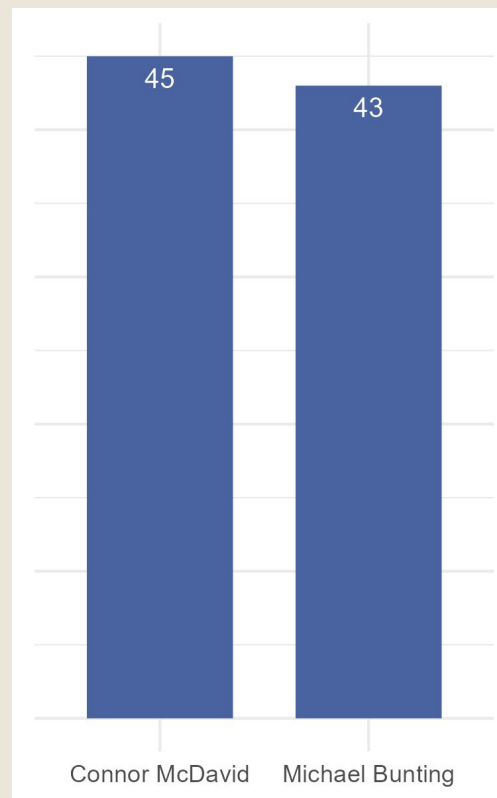


# PENALTY PATHWAY

Connor McDavid and Michael Bunting lead the league in the 2022-2023 NHL season for penalties drawn with 45 and 43 penalties drawn respectively.

Given McDavid and Bunting have a substantial count of penalties drawn, does this indicate their ability to create power play opportunities? Are these events where penalties are drawn leading to power plays or are other penalties that occur at the same time offsetting these results?

Our focus in this project was to determine what NHL players draw the most power plays.



# DATA

Using a combination of play-by-play data from hockeyR and player statistics data from Natural Stat Trick we were able to create a Power Plays drawn metric.

## hockeyR play-by-play data

season_13_14	414453 obs. of 109 variables	🗖
season_14_15	419900 obs. of 109 variables	🗖
season_15_16	411002 obs. of 109 variables	🗖
season_16_17	410520 obs. of 109 variables	🗖
season_17_18	431856 obs. of 109 variables	🗖
season_18_19	430380 obs. of 109 variables	🗖
season_19_20	377844 obs. of 109 variables	🗖
season_20_21	284536 obs. of 107 variables	🗖
season_21_22	431914 obs. of 109 variables	🗖
season_22_23	429879 obs. of 111 variables	🗖

**IMPORTANT:** For this project, players are credited only once for a penalty on, drew by, and power play drawn when multiple penalties occur simultaneously.

Period	Seconds	Penalty On	Penalty On ID	Drew by	Drew by ID	Drew PP	Drew PP ID
3	697	Jason.Zucker	8475722	Brendan.Lemieux	8477962	Brendan.Lemieux	8477962
3	697	Brendan.Lemieux	8477962	Tristan.Jarry	8477465	NA	NA
3	697	Jason.Zucker	NA	Brendan.Lemieux	NA	NA	NA

## Cleaned Data Table from Created Shiny App

Copy CSV Excel PDF Print Search:

Season 2022-2023 Regular Season penalties table for players with more than 10 games played

	Player	Team	Pos	GP	TOI	PP Drawn	PP Drawn/60	Pen Drawn	Pen Drawn/60	Pen Taken	Pen Taken/60
38	Connor McDavid	EDM	F	82	1835.62	38	1.24	44	1.44	18	0.59
29	Brad Marchand	BOS	F	73	1352.55	30	1.33	41	1.82	35	1.55
34	Elias Pettersson	VAN	F	80	1644.38	35	1.28	39	1.42	7	0.26
79	Michael Bunting	TOR	F	82	1295.35	22	1.02	39	1.81	40	1.85

# CREATING NEW VARIABLES & CALCULATING PER 60 STATISTICS

## Created Variables

Penalty On	Player whos is guilty of penalty
Drew By	Player who drew the penalty
Drew Power Play	Player who drew the power play

Each of the created variables in the play-by-play data also have corresponding player id and team columns.

Most of the penalty events have a pattern in the description column.

There were four different patterns.

Description	Player 1	Player 2	Player 3	Penalty On	Drew By
Ryan Johansen Slashing against Noah Gregor	Ryan.Johansen	Noah.Gregor	NA	Ryan.Johansen	Noah.Gregor
Kiefer Sherwood Delaying Game	Kiefer.Sherwood	NA	NA	Kiefer.Sherwood	NA
Nick Ritchie Roughing against Evgeni Malkin served by Zack Kassian	Nick.Ritchie	Evgeni.Malkin	Zack.Kassian	Nick.Ritchie	Evgeni.Malkin
Jack Campbell Delaying Game - Puck over glass served by Connor McDavid	Jack.Campbell	Connor.McDavid	NA	Jack.Campbell	NA

## Importance of Per 60 Metric:

Raw counts are not sufficient in evaluating a players ability to draw power plays. To be able to compare for players who spent more time on the ice versus ones with less we calculated a players per 60 metric.

General Equation to calculate per 60 statistic:

$$\text{Per 60 Stat} = \frac{\text{Total Count}}{\text{Total Time On Ice}} * 60$$

# THE REPEATABILITY OF POWER PLAYS DRAWN



In order to evaluate the repeatability of our new power plays drawn metric we used a simple linear regression model.

$$PP\ Drawn_x = \beta_0 + \beta_1 (PP\ Drawn_{x-1})$$

where:

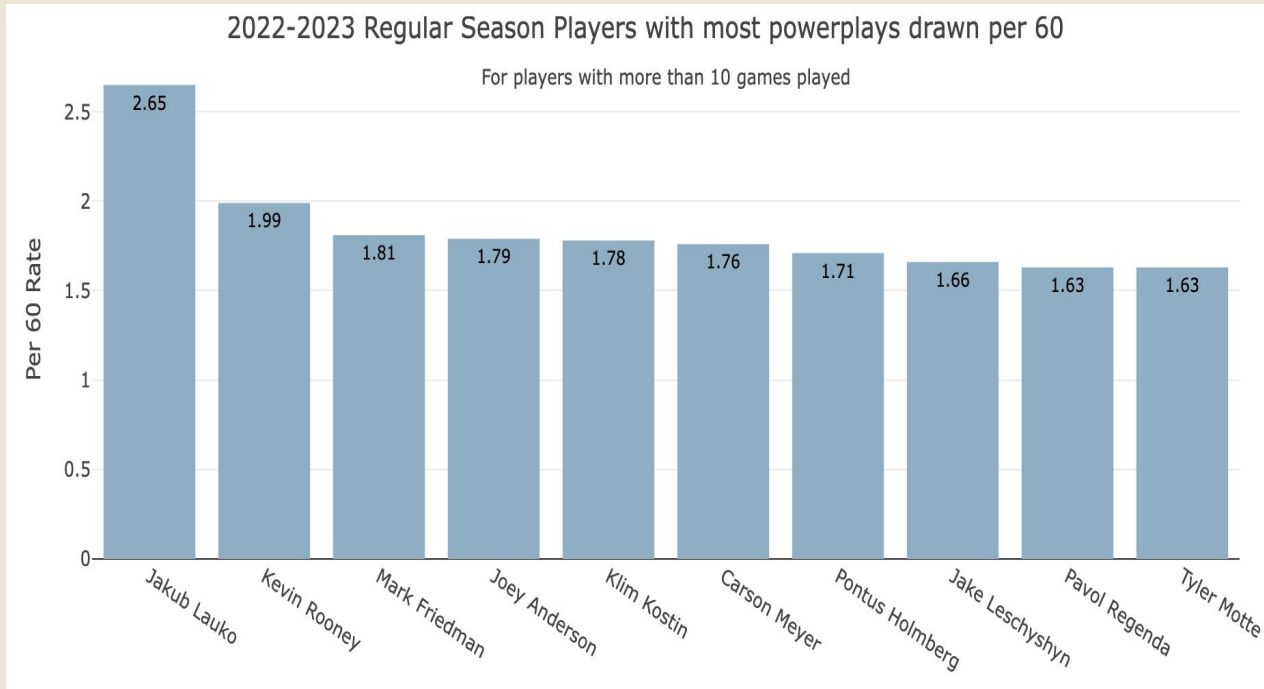
x is the response season

x - 1 is the explanatory (previous)season

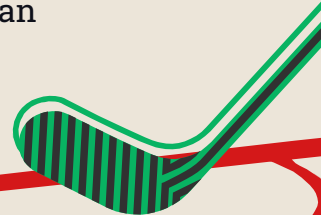
On average 30.5% of power plays drawn per 60 for a player is explained by that players previous years power plays drawn per 60 statistic.

Response Season	Explanatory Season	R-Squared
2022-2023	2021-2022	0.324
2021-2022	2020-2021	0.279
2020-2021	2019-2020	0.313
2019-2020	2018-2019	0.301
2018-2019	2017-2018	0.284
2017-2018	2016-2017	0.323
2016-2017	2015-2016	0.327
2015-2016	2014-2015	0.281
2014-2015	2013-2014	0.311

# PLAYERS WITH MOST POWER PLAYS DRAWN (BY PER 60)



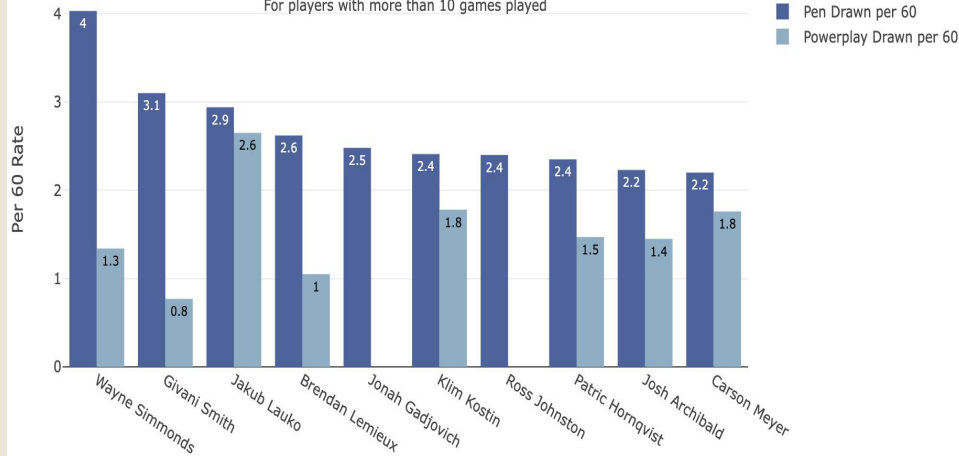
- The per 60 rates provide a more accurate evaluation of players' ability to draw power plays and penalties compared to raw counts, accounting for differences in ice time
- Example: Mark Friedman



# DRAWING BLANKS: PENALTIES DRAWN VS POWER PLAYS DRAWN

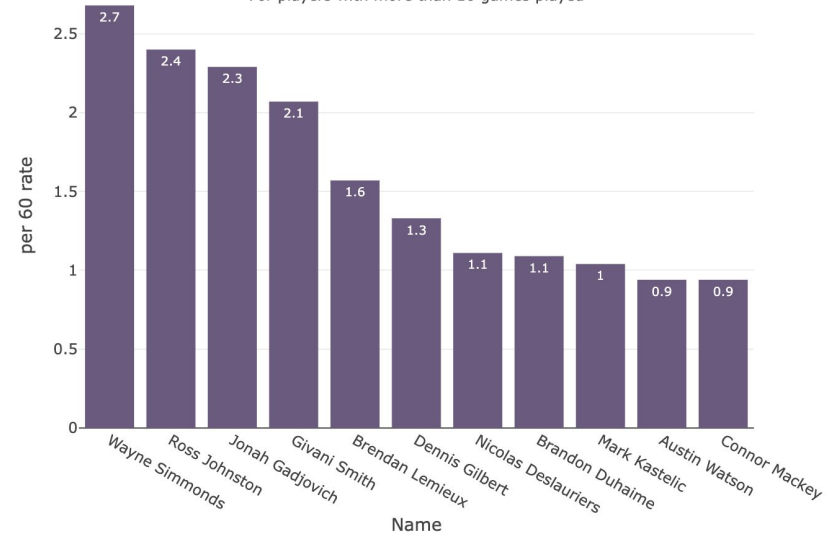
2022-2023 Regular Season Players with most penalties drawn per 60

For players with more than 10 games played

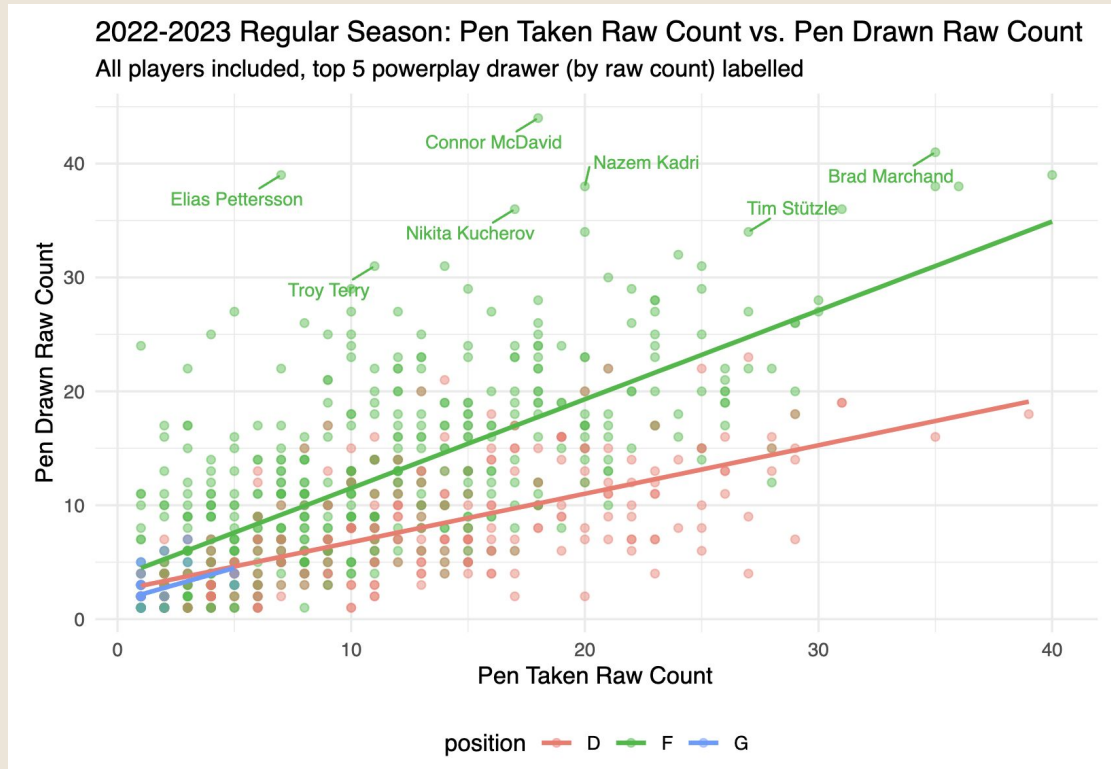


2022-2023 Regular Season Players with most offsetting penalties drawn

For players with more than 10 games played



# POSITIONS, PENALTIES AND POWER PLAYS

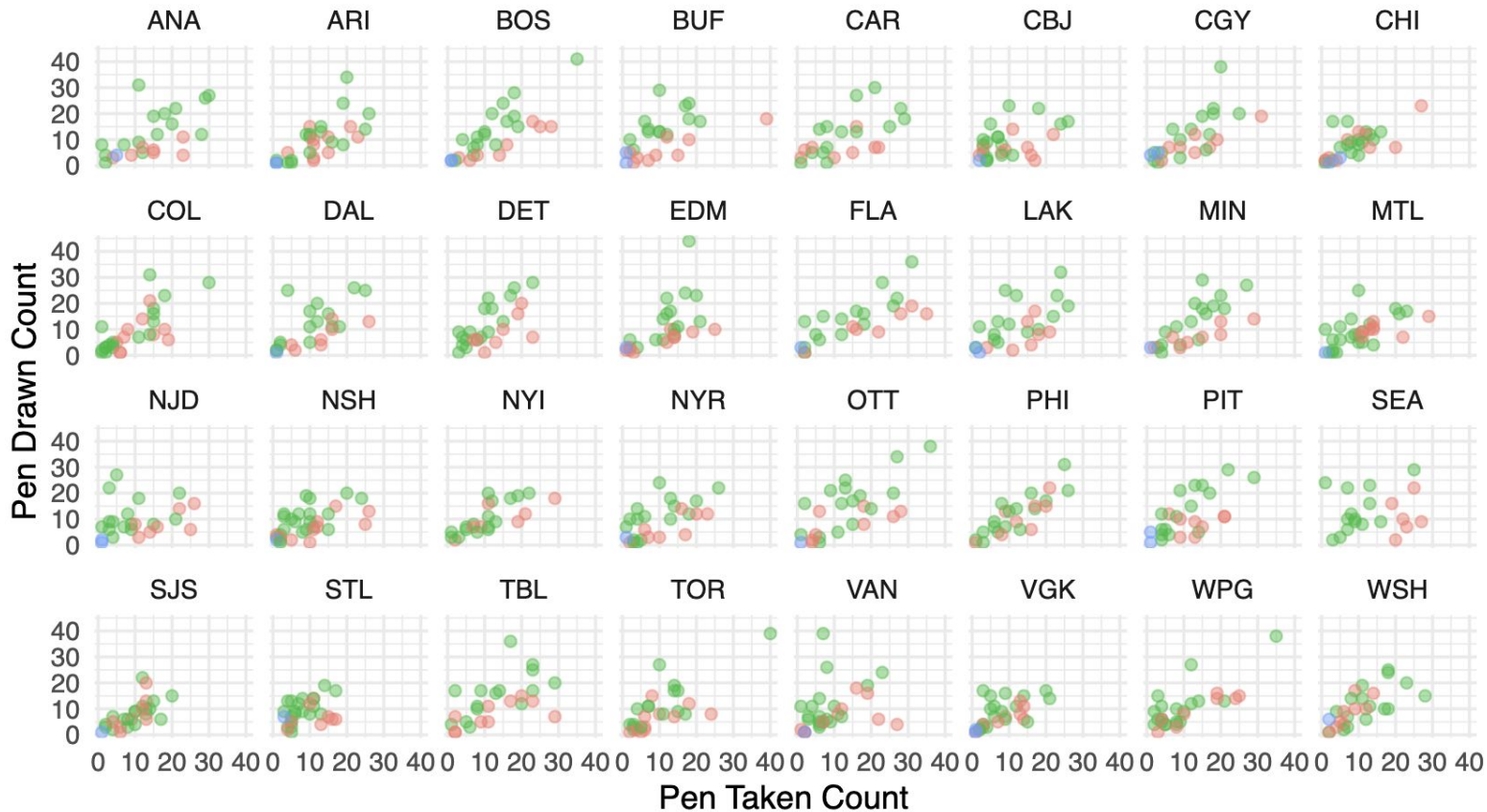


Forwards are more likely to draw penalties than defense players given the same penalty-taken amount.



# 2022-2023 Regular Season Pen Taken vs. Pen Drawn (Raw Count) for Teams

Players with more than 10 Games Played Included





# LIMITATIONS



## FILTERS

- The 2-game played threshold for playoffs could introduce biased per 60 statistics.
- Filters could unintentionally exclude players with exceptional penalty or powerplay drawing ability but limited games played.

## ERROR IN DATA

The penalty-drawn and powerplay-drawn data are obtained through string analysis of the description column, which contains inconsistent documentation, in the hockeyR dataset. As a result, the dataset may contain errors related to penalty count and types.

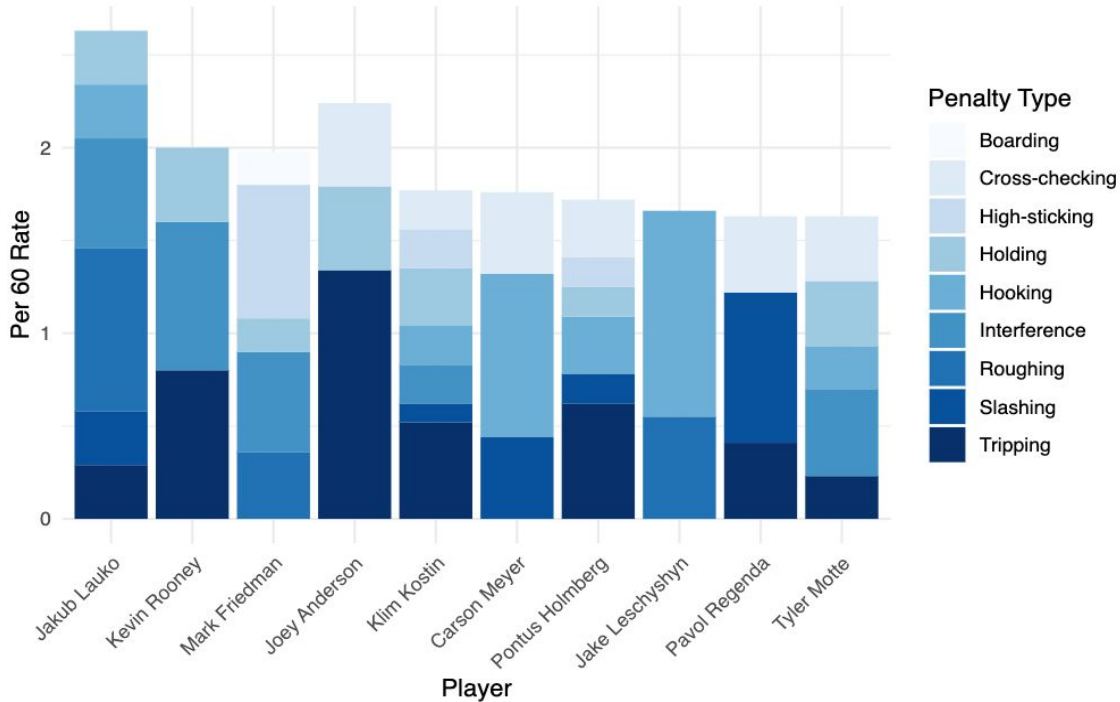


# FUTURE STEPS

- Model the time distribution of each type of penalty called and the time distribution of goals during power plays to predict potential impacts on game success if teams complete their penalty time after the end of a period or game.
- Model the patterns of types of penalties called for each season to predict the most frequently called penalty in the upcoming season.
- Modify the data pipeline and resolve existing data-related issues in the current dataset.
- Develop a penalty types breakdown for individual players' power play-drawn, identifying the top contributing penalty types.

# A PROTOTYPE FOR PENALTY TYPES BREAKDOWN

2022-2023 Regular Season Players with most power play drawn per 60  
For Players with more than 10 Games Played



# LINK TO SHINY APP



Currently optimized for displaying on computer